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# INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal-500043, Hyderabad

**B.Tech III SEMESTER END EXAMINATIONS (REGULAR) - FEBRUARY 2022**

Regulation:UG-20

## PROBABILITY AND STATISTICS

**Time: 3 Hours**

**(AE|ME)**

**Max Marks: 70**

**Answer ALL questions in Module I and II**

**Answer ONE out of two questions in Modules III, IV and V**

NOTE: Provision is given to answer TWO questions from among one of the Modules III / IV / V

**All Questions Carry Equal Marks**

**All parts of the question must be answered in one place only**

### MODULE – I

1. (a) A random variable X has the probability function shown in Table 1: [7M]

Table 1

x	0	1	2	3	4	5	6	7
f(x)	0	K	2k	2k	3k	$k^2$	$2k^2$	$K + 7k^2$

Evaluate i) k ii)  $P(3 < x < 7)$  iii) Find the minimum value of x so that  $P(X \leq x) > 0.5$

- (b) Is the function defined by  $\begin{cases} \frac{x^3}{3}, & -1 < x < 2 \\ 0 & \text{elsewhere} \end{cases}$  a probability density function?

Evaluate i)  $P(0 < X \leq 1)$  ii)  $P(0 < X < 2)$  [7M]

### MODULE – II

2. (a) Out of 800 families with 4 children each, how many families would be expected to have
- 2 boys and 2 girls
  - At least one boy
  - At most two girls
- (b) Given a standard normal distribution, find the area under the curve which lies
- To the left of  $z = 1.43$
  - To the right of  $z = -0.89$
  - Between  $z = -2.16$  and  $z = -0.65$
  - Find the value of k such that  $P(z < k) = 0.0427$

### MODULE – III

3. (a) A researcher wished to determine if a person's age is related to the number of hours He or she exercises per week. The data obtained from a sample is given in Table 2. State your opinion based on Karl Pearson's coefficient of correlation. [7M]

Table 2

<b>Age(x)</b>	18	26	32	38	52	59
<b>Hours(y)</b>	10	5	2	3	1.5	1

- (b) The Table 3 shows how many weeks a sample of 6 persons have worked at an automobile inspection station and the number of cars each one inspected between noon and 2 PM on a given day. Obtain the regression equation  $y$  on  $x$  [7M]

Table 3

<b>Number of weeks employed</b>	2	7	9	1	5	12
<b>Number of cars inspected</b>	13	21	23	14	15	21

4. (a) The marks secured by recruits in the selection test (X) and in the proficiency test (Y) are given in Table 4. Obtain the rank correlation for the given data. [7M]

Table 4

<b>X</b>	10	15	12	17	17	16	24	14	22
<b>Y</b>	30	42	45	46	33	34	40	35	30

- (b) The grades of a class of 6 students on a midterm report ( $x$ ) and on the final examination ( $y$ ) are given in Table 5. [7M]

Table 5

<b>x</b>	77	50	71	72	81	94
<b>y</b>	82	66	78	34	47	85

- i) Estimate the linear regression line  
 ii) Estimate the final examination grade of a student who received a grade of 85 on the mid term report.

#### MODULE – IV

5. (a) A random sample of size 100 is taken from an infinite population having the mean 76 and the variance 256. Estimate the probability that will be between 75 and 78. [7M]  
 (b) A population consists of the five numbers 2, 3, 6, 8, 11. Consider all possible samples of size two which can be drawn with replacement from this population.  
 Find  
 i) The mean of the sampling distribution  
 ii) The standard deviation of the sampling distribution of means [7M].
6. (a) A normal population has a mean of 6.8 and standard deviation of 1.5. A sample of 400 members gave a mean of 6.75. Is the difference significance? [7M]  
 (b) From the data given in Table 6, compute the standard error of the difference of the two sample means and find out if the two means significantly differ at 5% level of significance. [7M]

Table 6

	No. of items	Mean	Standard Deviation
<b>Group-I</b>	50	181.5	3.0
<b>Group-II</b>	75	179	3.6

**MODULE – V**

7. (a) A random sample of size 16 has 53 as its mean. The sum of squares of deviation from mean is 135. Can this sample be regarded as taken from the population having 56 as its mean?

[7M]

- (b) The color of eyes of fathers and sons are given in Table 7.

Test if the color of the son's eye is associated with that of the father.

[7M]

Table 7

	Eye color of son		
Eye color of father		Light	Not light
	Light	471	51
	Not light	148	230

8. (a) In two independent samples of size 8 and 10, the sum of squares of deviation of the sample values from the respective sample means were 84.4 and 102.6. Test whether the difference of variances of the populations is significant or not.

[7M]

- (b) A die is thrown 270 times and the results of these throws are given in Table 8.

Test whether the die is biased or not.

[7M]

Table 8

No. appeared on the die	1	2	3	4	5	6
Frequency	40	32	29	59	57	59

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